ATTORNEY'S DOCKET NO.: S1022.80742US00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Tahir RASHID		
Serial No.:	09/944,637	Patent No. 6,891,443 B2	
Filed:	August 31, 2001	Issued: May 10, 2005	Certificate
For:	OSCILLATOR		MAY 24 2005
Examiner:	Linh V. Nguyen		
Art Unit:	2819	Confirmation No.: 9234	of Correction

ATTN: Certificate of Correction Branch
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REQUEST FOR CERTIFICATE OF CORRECTION

Sir/Madam:

Patentee respectfully requests the correction of an error found in the above-captioned patent. There is a typographical errors in columns1, 2, 5 and 6 of issued U.S. Patent No. 6,891,443.

More specifically:

(1) In column 1, line 13, a period is missing from the end of the sentence, "In some cases the oscillation frequency can increase with temperature, whereas in other cases the oscillation frequency can decrease with temperature".

(2) In column 2, line 65, the parenthetical term "(shorts)" should read "(shorts out)" as it appears on page 5, line 3 of the application as filed..

(3) In column 5, line 65, (claim 3, line 1) the word "Circuit" should read "Circuitry" as it appears in claim 7 of the amendment filed on July 12, 2004.

(4) In column 6, line 45, (claim 14, line 2) the word "means" should be inserted between "resistive comprises" as it appears in claim 20 of the amendment filed on July 12, 2004.

(5) In column 6, line 49, (claim 15, line 3) the word "a" should be delete and the word "to" should be inserted as it appears in claim 16 of the amendment filed on July 12, 2004.

No amendments were made by either the Examiner or Patentees to cause the above changes to appear in issued U.S. Patent No. 6,891,443.

In support of this request Patentee encloses a highlighted copy of pages 1 and 5 of the application as filed, the amendment filed July 12, 2004 and columns 1, 2, 5 and 6 of issued U.S. Patent No. 6,891,443. Also enclosed is PTO form SB/44.

The corrections requested do not involve change in the patent that constitutes new matter or would require reexamination. Therefore, it is respectfully requested that the correction be made and that a Certificate of Correction be issued.

Patentee respectfully submits that, since the errors for which a Certificate of Correction is sought was the result of Patent Office mistake, no fee is due. However, if the Examiner deems a fee necessary, the fee may be charged to the account of the undersigned, Deposit Account No. 23/2825.

Should any questions arise concerning the foregoing, please contact the undersigned at the telephone number listed below.

CERTIFICATE OF MAILING UNDER 37 C.F.R. §1.8(a)

I hereby certify that this document is being placed in the United States mail with first-class postage attached, addressed to ATTN: Certificate of Correction Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on May 17, 2005.

Gail Driscoll

Respectfully submitted,

Tahir Rashid, Applicant

By: _____

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Attorney Docket No.: S1022.80742US00
XNDD

MAY 24 2005

ATTORNEY'S DOCKET NO.: S1022.80742US00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Tahir RASHID	
Serial No.:	09/944,637	Patent No. 6,891,443 B2
Filed:	August 31, 2001	Issued: May 10, 2005
For:	OSCILLATOR	
Examiner:	Linh V. Nguyen	
Art Unit:	2819	Confirmation No.: 9234

ATTN: Certificate of Correction Branch
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir/Madam:

Transmitted herewith for filing is/are the following document(s):

[X] Request for Certificate of Correction
[X] Copies of: Pages 1 and 5 of the apl. as filed, the 07/12/04 Amend and Cols. 1, 2, 5 and 6 of issued U.S. Patent No. 6,891,443
[X] PTO Form SB/44
[X] Return Post Card

If the enclosed papers are considered incomplete, the Mail Room and/or the Application Branch is respectfully requested to contact the undersigned collect at (617) 646-8000, Boston, Massachusetts.

No check is enclosed. If it is determined that a fee is necessary, the fee may be charged to the account of the undersigned, Deposit Account No. 23/2825. A duplicate of this sheet is enclosed.

CERTIFICATE OF MAILING UNDER 37 C.F.R. §1.8(a)

I hereby certify that this document is being placed in the United States mail with first-class postage attached, addressed to ATTN: Certificate of Correction Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on May 17, 2005.

Respectfully submitted,

Tahir Rashid, Applicant

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Attorney Docket No.: S1022.80742US00
XNDDX

MAY 24 2005

Express Mail Label No. EL844514482US

TITLE OF THE INVENTION
OSCILLATOR

FIELD OF THE INVENTION

This invention relates to oscillator circuits and particularly to temperature compensated oscillator circuits.

BACKGROUND OF THE INVENTION

A problem with many known types of oscillator circuit is that variations in temperature cause changes in the oscillation frequency. In some cases the oscillation frequency can increase with temperature, whereas in other cases the oscillation frequency can decrease with temperature. For example, consider oscillator circuits which rely on repeated charging and discharging cycles of a capacitor to generate an oscillating voltage signal. A problem with such oscillator circuits can be that the rate of current flow on and off the capacitor C increases with increasing temperature. As a result, the capacitor charges and discharges faster at high temperatures and thus reaches respective upper and lower voltage limits in less time. This means that the frequency of the oscillating signal increases with temperature and hence such oscillators are unreliable in timing applications.

SUMMARY OF THE INVENTION

Embodiments of the present invention seek to provide oscillator circuits having improved temperature characteristics.

According to a first aspect of the present invention, there is provided oscillator circuitry comprising a capacitor; capacitor charging means arranged to supply a current to charge the capacitor to a first predetermined threshold voltage; capacitor discharging means arranged to discharge the capacitor to a second predetermined threshold voltage; and switching means

transistor M1 turned on, the capacitor C enters its discharging phase. The capacitor C is discharged by a predetermined amount. Since the conducting transistor M2 bypasses (shorts out) the third resistor R3, the voltage V_2 at the node 32 referred to the power supply rail 14 is reduced to a lower voltage. The capacitor C discharges until a lower threshold is reached at which point in time the comparator switches back thereby turning off the transistors M1 and M2 to begin the charging cycle again.

Thus the capacitor C is charged by the first current source 16 until an upper threshold voltage close to the supply voltage is reached. The current supply to the capacitor is then "reversed", such that the capacitor C is discharged until a lower threshold voltage close to zero volts is reached. The current supply is "reversed" again and the cycle repeated. Repeat cycles of charging and discharging the capacitor C produce voltage oscillations on the capacitor referred to the second power supply rail 14. The voltage across the capacitor plates represents a substantially triangular waveform over time. A square wave for example for use in timing applications can be produced from the triangular wave by taking the output of an inverter having its input connected to the capacitor or the output of the comparator.

Figure 2 shows an oscillator circuit 100 in accordance with an embodiment of the invention which is capable of generating an output signal having a frequency which is substantially independent of temperature variations. The oscillator circuit 100 comprises a first power supply rail 112 and a second power supply rail 114. A first IPTAT current source 116 is connected between the first power supply rail 112 and a first transistor M3. The transistor M3 has its controllable path connected between the first current source 116 and a second IPTAT current

IN THE CLAIMS

Applicant submits below a complete listing of the current claims, with insertions indicated by underlining and deletions indicated by strikeouts and/or double bracketing. This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of the Claims

1. (Currently amended) Oscillator circuitry comprising:

a capacitor;

capacitor charging means arranged to supply a current to charge the capacitor to a first predetermined threshold voltage;

capacitor discharging means arranged to discharge the capacitor to a second predetermined threshold voltage; and

switching means arranged to switch between a capacitor discharging mode and a capacitor charging mode responsive to reaching at least one of said threshold voltages, wherein the at least one threshold voltage is determined by a threshold setting means, ~~which provides a voltage threshold which varies~~

said threshold setting means comprising a series combination of at least one diode-connected transistor and a resistor, said threshold setting means setting the second predetermined voltage to compensate for changes in temperature ~~by varying a voltage difference~~ , so as to vary the voltage swing between said first predetermined threshold voltage and said second predetermined threshold voltage to maintain an oscillation frequency substantially independent of temperature.

2. (Currently amended) Circuitry as claimed in claim 1, wherein the threshold setting means further comprises a current source ~~and a resistive means which varies in resistance in dependence upon temperature~~.

3. (Original) Circuitry as claimed in claim 1, wherein the switching means comprises a comparator arranged to monitor voltage across the capacitor and to trigger a change between the discharging and charging modes.

ATTORNEY'S DOCKET NO.: S1022.80742US00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Tahir RASHID
Serial No.: 09/944,637
Filed: August 31, 2001
For: OSCILLATOR

Examiner: Linh V. Nguyen
Art Unit: 2819 Confirmation No. 9234

MAIL STOP RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir/Madam:

PRELIMINARY AMENDMENT

Prior to examination on the merits of the application, please amend the above-identified application as follows:

Amendments to the Claims begin on page 2 of this amendment.

Remarks begin on page 7 of this amendment.

4. (Currently amended) Circuitry as claimed in claim 3, wherein the comparator is connected to a first control transistor which ~~sets~~ selects the first and second predetermined threshold voltages ~~of~~ for charging and discharging the capacitor.

5. (Currently amended) Circuitry as claimed in claim 4, wherein the first control transistor is arranged to selectively by-pass ~~an element of a resistive chain~~ the resistor.

6. (Original) Circuitry as claimed in claim 3, wherein the comparator is connected to a second control transistor which controls current flow to facilitate charging and discharging of the capacitor means.

7. (Currently amended) Circuitry as claimed in claim 2, wherein the ~~resistive~~ threshold setting means comprises more than one ~~or more~~ diode connected transistors.

8. (Original) Circuitry as claimed in claim 1, wherein the capacitor charging means comprises a current source.

9. (Original) Circuitry as claimed in claim 1, wherein the capacitor discharging means comprises a current source.

10. (Currently amended) Oscillator circuitry comprising:

a capacitor;

a capacitor charger arranged to supply a current to charge the capacitor to a first predetermined threshold voltage;

a capacitor discharger arranged to discharge the capacitor to a second predetermined threshold voltage; and

a switch arranged to switch between a capacitor discharging mode and a capacitor charging mode responsive to reaching at least one of said threshold voltages, wherein the at least one threshold voltage is determined by ~~a threshold setting means~~ a series combination of at least one diode-connected transistor and a resistor, said combination setting the second predetermined voltage ~~which provides a voltage threshold which varies~~ to compensate for changes in temperature ~~by varying a voltage difference~~ so as to vary the voltage swing between

said first predetermined threshold voltage and said second predetermined threshold voltage to maintain an oscillation frequency substantially independent of temperature.

11. (Cancelled).

12. (Cancelled).

13. (Previously Presented) The oscillator circuitry of claim 1, wherein a charge and discharge frequency of the capacitor is independent of temperature.

14. (Previously Presented) The oscillator circuitry of claim 3, wherein a comparator output frequency is independent of temperature.

15. (Currently amended) The oscillator circuitry of claim 10, wherein the ~~threshold setting means~~ series combination further comprises a current source ~~and a resistive means which varies in resistance in dependence upon temperature~~.

16. (Previously Presented) The oscillator circuitry of claim 10, wherein the switch comprises a comparator arranged to monitor voltage across the capacitor and to trigger a change between the discharging and charging modes.

17. (Currently amended) The oscillator circuitry of claim 16, wherein the comparator is connected to a first control transistor which ~~sets~~ selects the first and second predetermined threshold voltages ~~of~~ for charging and discharging the capacitor.

18. (Currently amended) The oscillator circuitry of claim 17, wherein the first control transistor is arranged to selectively by-pass ~~an element of a resistive chain~~ the resistor.

19. (Previously Presented) The oscillator circuitry of claim 16, wherein the comparator is connected to a second control transistor which controls current flow to facilitate charging and discharging of the capacitor.

20. (Currently amended) The oscillator circuitry of claim 15, wherein the resistive means comprises more than one ~~or more~~ diode connected transistors.

21. (Previously Presented) The oscillator circuitry of claim 10, wherein the capacitor charger comprises a current source.

22. (Previously Presented) The oscillator circuitry of claim 10, wherein the capacitor discharger comprises a current source.

23. (Cancelled).

24. (Cancelled).

25. (Previously Presented) The oscillator circuitry of claim 10, wherein a charge and discharge frequency of the capacitor is independent of temperature.

26. (Previously Presented) The oscillator circuitry of claim 16, wherein a comparator output frequency does not vary with temperature.

27. (Currently amended) A method of providing an oscillating voltage signal, the method comprising the acts of:

increasing a voltage signal until the voltage signal reaches a first threshold voltage;

decreasing the voltage signal until the voltage signal reaches a second threshold voltage; and

varying a difference between the first threshold voltage and the second threshold voltage, wherein the second predetermined voltage is determined by a series combination of at least one diode-connected transistor and a resistor, the second predetermined voltage is varied in response to changes in temperature to maintain an oscillation frequency substantially independent of temperature.

28. (Previously Presented) The method of claim 27, wherein the act of increasing the voltage signal includes an act of increasing the voltage signal at a rate that varies with temperature.

29. (Previously Presented) The method of claim 27, wherein the act of decreasing the voltage signal includes an act of decreasing the voltage signal at a rate that varies with temperature.

30. (Previously Presented) The method of claim 27, wherein the act of increasing the voltage signal includes an act of charging a capacitor.

31. (Previously Presented) The method of claim 27, wherein the act of decreasing the voltage signal includes an act of discharging a capacitor.

REMARKS

In view of the foregoing amendments and remarks, this application should now be in condition for allowance. A notice to this effect is respectfully requested. If the Examiner believes, after this amendment, that the application is not in condition for allowance, the Examiner is requested to call the Applicant's attorney at the telephone number listed below.

If this response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicant hereby requests any necessary extension of time. If there is a fee occasioned by this response, including an extension fee that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 23/2825.

CERTIFICATE OF MAILING UNDER 37 C.F.R. §1.8(a)

I hereby certify that this document is being placed in the United States mail with first-class postage attached, addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on July 12, 2004.

Gail Driscoll

Attorney Docket No.: S1022.80742US00
X07/12/04

Respectfully submitted,

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OSCILLATOR

FIELD OF THE INVENTION

This invention relates to oscillator circuits and particularly to temperature compensated oscillator circuits.

BACKGROUND OF THE INVENTION

A problem with many known types of oscillator circuit is that variations in temperature cause changes in the oscillation frequency. In some cases the oscillation frequency can increase with temperature, whereas in other cases the oscillation frequency can decrease with temperature For example, consider oscillator circuits which rely on repeated charging and discharging cycles of a capacitor to generate an oscillating voltage signal. A problem with such oscillator circuits can be that the rate of current flow on and off the capacitor C increases with increasing temperature As a result, the capacitor charges and discharges faster at high temperatures and thus reaches respective upper and lower voltage limits in less time. This means that the frequency of the oscillating signal increases with temperature and hence such oscillators are unreliable in timing applications.

SUMMARY OF THE INVENTION

Embodiments of the present invention seek to provide oscillator circuits having improved temperature characteristics.

According to a first aspect of the present invention, there is provided oscillator circuitry comprising a capacitor; capacitor charging means arranged to supply a current to charge the capacitor to a first predetermined threshold voltage; capacitor discharging means arranged to discharge the capacitor to a second predetermined threshold voltage; and switching means arranged to switch between a capacitor discharging mode and a capacitor charging mode responsive to reaching at least one of said threshold voltages, wherein the at least one threshold voltage is determined by a threshold setting means which provides a voltage threshold which varies to compensate for changes in temperature.

Preferably, the threshold setting means comprises a current source and a resistive means which varies in resistance in dependence upon temperature.

In preferred embodiments, the switching means comprises a comparator arranged to monitor voltage across the capacitor and to trigger a change between the discharging and charging modes.

In such case, the comparator is connected to a first control transistor which sets the first and second predetermined threshold voltages of the capacitor

The first control transistor may be arranged to selectively by-pass an element of a resistive chain.

Preferably, the comparator is also connected to a second control transistor which controls current flow to facilitate charging and discharging of the capacitor means.

Typically, the resistive means comprises one or more diode-connected transistors.

Each said capacitor charging means comprising a current source and preferably an IPTAT current source. Preferably, each said capacitor discharging means comprises a current source of the same type.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings in which:

FIG. 1 shows a first embodiment of an oscillator circuit;

FIG. 2 shows another oscillator circuit embodying the present invention; and

FIG. 3 shows the variation of output voltage over time for the oscillator of FIG. 2 at two different temperatures.

DESCRIPTION OF PREFERRED EMBODIMENTS OF THE PRESENT INVENTION

One type of oscillator circuit **10** is shown in FIG. **1**. The oscillator circuit **10** comprises a first power supply rail **12** and a second power supply rail **14**. A first current source **16** is connected between the first power supply rail **12** and a first transistor M1 to generate IPTAT, a current proportional to absolute temperature. The transistor M1 has its controllable path connected between the first current source **16** and a second IPTAT current source **18** which is itself connected to the second power supply rail **14**. The first current source **16**, the transistor M1 and the second current source **18** are connected in series between the first power supply rail **12** and the second power supply rail **14**.

A capacitor C has a first terminal connected to a node **20** between the first current source **16** and the transistor M1. The second terminal of the capacitor C is connected to the second power supply rail **14**. A comparator **30** is disposed in the circuit **10** so as to comprise a switching device. The comparator **30** has a first (positive) input connected to the first terminal of the capacitor C and the node **20** between the first current source **16** and the transistor M1. A second (negative) input of the comparator **30** is connected to a node **32** of a resistive chain comprising first, second and third resistors R_1, R_2 and R_3. The resistors R_1, R_2 and R_3 are connected in series between the first power supply rail **12** and the second power supply rail **14**. The node **32** to which the second input of the comparator **30** is connected is at the junction between the first resistor R_1 and the second resistor R_2 of the resistive chain R_1, R_2 and R_3.

The output **34** of the comparator **30** is supplied to the control terminal of a further transistor M2 which has its controllable path connected between the second power supply rail **14** and a node **36** between the second resistor R_2 and the third resistor R_3 of the resistive chain R_1, R_2 and R_3. The output **34** of the comparator **30** is also supplied to the control terminal of the first transistor M1. The first and second transistors M1 and M2 are thus both controlled by the output signal of the comparator **30**.

In the above circuit there are two current sources **16**,**18**. The first current source **16** produces the current I and the second current source **18** produces the current 2I. In the charging phase of the capacitor, the transistors M1 and M2 are turned off. With the transistor M1 in an off state, the current I from the first current source **16** is supplied to the first terminal of the capacitor C. The voltage V_1 on the capacitor C (i.e. the voltage on the first terminal of the capacitor referred to the second supply rail) rises until it reaches the voltage V_2 of the junction between the first and second resistors R_1 and R_2 referred to the second supply rail **14**.

When the voltage V_1 on the capacitor C reaches the voltage V_2 at the node **32**, the transistors M1 and M2 are turned on. With the transistor M1 turned on, the capacitor C enters its discharging phase. The capacitor C is discharged by a predetermined amount. Since the conducting transistor M2 bypasses (shorts) the third resistor R3, the voltage V_2 at the node **32** referred to the power supply rail **14** is reduced to a lower voltage. The capacitor C discharges until a lower

threshold during the discharging phase of a capacitor C' in a circuit such as that shown in FIG. 2 is dependent on the resistance of the diode-connected transistor. The lower voltage threshold LL_{T2} at temperature T_2 is less than the lower voltage threshold LL_{T1} at the temperature T_1. The voltage across the diode-connected transistor M5 gets smaller with increasing temperature and hence the lower voltage threshold LL_{T2} at higher temperatures is shifted to a lower value by a potential difference ΔV. The downward shift in the lower voltage threshold means that the capacitor C' must undertake a larger voltage swing between the upper and lower voltage thresholds defining the charged and discharged states. The larger voltage swing compensates for the increased charging and discharging rates such that the period of oscillation at the higher temperature is substantially the same as in the lower temperature case (i.e. the period t_1=the period t_2). That is, the oscillation frequency remains the same at the higher temperature T_2 as it is at the lower temperature T_1.

Oscillator circuits embodying the present invention can provide an oscillating waveform at frequencies which do not vary in dependence upon temperature conditions. This is achieved by employing threshold voltage setting means which can vary a voltage level at which the oscillator switches between oscillation cycles in dependence upon the temperature of the environment in which the oscillator is operating.

In the preferred embodiment a current source is implemented as a single diode-connected transistor M5. The skilled person would appreciate that while only one such diode-connected transistor is designated by reference numeral M5 two or more diode-connected transistors may be coupled together and used to facilitate larger voltage swings.

Embodiments of the present invention are not limited to the configuration of the embodiment described herein. Specifically the embodiment described herein is intended to illustrate one example of a configuration which may be used to implement the invention.

What is claimed is:

1. Oscillator circuitry comprising:

a capacitor;

capacitor charging means arranged to supply a current to charge the capacitor to a first predetermined threshold voltage;

capacitor discharging means arranged to discharge the capacitor to a second predetermined threshold voltage; and

switching means arranged to switch between a capacitor discharging mode and a capacitor charging mode responsive to reaching at least one of said threshold voltages, wherein the at least one threshold voltage is determined by a threshold setting means,

said threshold setting means comprising a series combination of at least one diode-connected transistor and a resistor, said threshold setting means setting the second predetermined voltage to compensate for changes in temperature, so as to vary the voltage swing between said first predetermined threshold voltage and said second predetermined threshold voltage to maintain an oscillation frequency substantially independent of temperature.

2. Circuitry as claimed in claim 1, wherein the threshold setting means further comprises a current source.

3. Circuit as claimed in claim 2, wherein the threshold setting means comprises more than one diode connected transistors.

4. Circuitry as claimed in claim 1, wherein the switching means comprises a comparator arranged to monitor voltage across the capacitor and to trigger a change between the discharging and charging modes.

5. Circuitry as claimed in claim 4, wherein the comparator is connected to a first control transistor which selects the first and second predetermined threshold voltages for charging and discharging the capacitor.

6. Circuitry as claimed in claim 5, wherein the first control transistor is arranged to selectively by-pass the resistor.

7. Circuitry as claimed in claim 4, wherein the comparator is connected to a second control transistor which controls current flow to facilitate charging and discharging of the capacitor means.

8. The oscillator circuitry of claim 4, wherein a comparator output frequency is independent of temperature.

9. Circuitry as claimed in claim 1, wherein the capacitor charging means comprises a current source.

10. Circuitry as claimed in claim 1, wherein the capacitor discharging means comprises a current source.

11. Oscillator circuitry comprising:

a capacitor;

a capacitor charger arranged to supply a current to charge the capacitor to a first predetermined threshold voltage;

a capacitor charger arranged to discharge the capacitor to a second predetermined threshold voltage; and

a switch arranged to switch between a capacitor discharging mode and a capacitor charging mode responsive to reaching at least one of said threshold voltages, wherein the at least one threshold voltage is determined by a series combination of at least one diode-connected transistor and a resistor, said combination setting the second predetermined voltage to compensate for changes in temperature so as to vary the voltage swing between said first predetermined threshold voltage and said second predetermined threshold voltage to maintain an oscillation frequency substantially independent of temperature.

12. The oscillator circuitry of claim 1, wherein a charge and discharge frequency of the capacitor is independent of temperature.

13. The oscillator circuitry of claim 11, wherein the series combination further comprises a current source.

14. The oscillator circuitry of claim 13, wherein the resistive comprises more than one diode connected transistors.

15. The oscillator circuitry of claim 11, wherein the switch comprises a comparator arranged to monitor voltage across the capacitor and a trigger a change between the discharging and charging modes.

16. The oscillator circuitry of claim 15, wherein the comparator is connected to a first control transistor which selects the first and second predetermined threshold voltages for charging and discharging the capacitor.

17. The oscillator circuitry of claim 16, wherein the first control transistor is arranged to selectively by-pass the resistor.

18. The oscillator circuitry of claim 15, wherein the comparator is connected to a second control transistor which controls current flow to facilitate charging and discharging of the capacitor.

19. The oscillator circuitry of claim 15, wherein a comparator output frequency does not vary with temperature.

20. The oscillator circuitry of claim 11, wherein the capacitor charger comprises a current source.

21. The oscillator circuitry of claim 11, wherein the capacitor discharger comprises a current source.

PTO/SB/44 (04-04)
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(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,891,443
DATED : April 26, 2005
INVENTOR(S) : Jean-Michel Ravon

It is certified that errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Col. 1, line 13, should read:

--lation frequency can decrease with temperature.--

Col. 2, line 65, should read:

--M2 bypasses (shorts) the third resistor R3, the voltage V_2 at--

Col. 5, line 65, should read:

--Circuitry as claimed in claim 2, wherein the threshold --

Col. 6, line 45, should read:

--resistive means comprises more than one diode connected transis--

Col. 6, line 49, should read:

--the capacitor and to trigger a change between the discharging --

MAILING ADDRESS OF SENDER

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PATENT NO. 6,891,443

MAY 2 4 2005